The use of the REX Robotic Exercise System, not for walking but for pain management and rehabilitation in the neck and shoulders of a 35 year-old male with a Spinal Cord Injury.

connect neuro PHYSIOTHERAPY

A SINGLE CASE REPORT

The participant had a complete T5 SCI from a traumatic accident 10 years ago. He has been living an independent lifestyle from his wheelchair since and has suffered with chronic right shoulder, neck and thoracic spine pain with intermittent headaches for the past 2 years.

INTRODUCTION

A serious Spinal Cord Injuries (SCI) can result in the long-term use of a wheelchair and up to 78% will suffer with ongoing shoulder, neck and back pain as well as instability, potentially causing irreversible damage affecting an individual's independence and quality of life. To date upper limb rehabilitation and management for SCI individuals is often delivered in a sitting position which has postural limitations.

Exoskeletons and robotic mobility aids have started to impact neurological rehabilitation in SCI, offering carefully-selected patients the opportunity of robot-supported walking. The REX is currently the only free standing robotic mobility aid and allows several rehabilitation angles to be addressed separate from gait training. A robotic device could increase its clinical impact if it could provide more outcomes for an individual than just the opportunity to walk and could provide a much wider range and depth of rehabilitation to be delivered.

The aim of the treatment described in this case report was to see if upper limb rehab provided in the REX in several different stance positions could accelerate upper limb rehabilitation and achieve better overall outcomes in addition to the positive effects of standing.

METHOD

The participant received once a week therapy for 1 hour focusing on upper quadrant rehabilitation including scapular setting exercises, core stability and cardiovascular exercise with the upper body in REX robotic exercise system. Time spent in the REX varied between 30 minutes to 45 minutes per session. The participant also completed a progressive home program over the 10 weeks.

Outcome measures include; Goal Attainment Scale (GAS), Canadian Occupational Performance Measure (COPM) and the Numeric Pain Rating Scale.

THE REX

Is stable enough to walk, move and stand with supervision without the participant having to use crutches or a frame, allowing the participant's hands and upper body to be able to move freely. The REXercise program allows several different static and dynamic standing positions be achieved, increasing its clinical application in respect to body positions and allowing easy movement around the clinic between equipment.

We would like to thank Rex Bionics for allowing us to use the REX in our clinic

REX BIONICS (Rex Bionics Ltd, Auckland, New Zealand)

RESULTS

Significant improvements were recorded in the participant's quality of life and a perception of pain in the neck, shoulders, and upper thoracic spine; as well as a complete elimination of headaches.

- GAS improved significantly from -4 to +3
- COPM improved significantly from 6 to 20
- Numeric Pain rating scale improved with current pain reducing from 4/10 to 2/10, best pain reducing from 4/10 to 1/10 and worst pain reducing from 9/10 to 4/10.

Goal Attainment Scale	Pre-Treatment Scores	Post 10-week Rehab Treatment Scores
1. Reduce pain in-between shoulders	-1 = Frequent pain most days	+1 = Rare shoulder pain
2. Decrease headaches	-1 = Frequent headaches	+2 = No headaches for last few weeks
3. Strengthen shoulder for long term use	-1 = Aware that shoulders are not in a good position	0 = Functional scapular setting for 50%
4. Improve sitting posture	-1 = significant scoliosis and reliant on one hand holding on	0 = Improved alignment by 30% and sitting balance for 10sec

Canadian Occupational Performance Measure	Pre-Treatment scores	Post 10-week Rehab Treatment Scores
Sleep through the night without waking up with pins and needles in arms and shoulders	3/10	10/10 Performance and satisfaction

DISCUSSION

The results have demonstrated that upper limb rehabilitation training delivered in a robotic exercise device resulted in significant improvements in upper body pain management and quality of life for a SCI individual. The results follow extensive research confirming that chronic SCI can still benefit from targeted upper quadrant rehabilitation to reduce pain and improve overall function of the upper body.

From a clinical application, the REX was easy to use as a single therapist, it kept the participant in the correct lower limb alignment while allowing a range of upper torso positions to be achieved to provide functional retraining of the upper quadrant. Other benefits reported from the case report was the psychological benefits of being upright and moving in a robotic mobility aide.

To date the advances in technology have provided the rehabilitation world with robotic mobility devices such as exoskeletons with a focus on walking. However, this case report demonstrates that a stand-alone device can provide rehabilitation to the upper body in not only a standing position but in several dynamic and static upright positions. These results will hopefully encourage further research to be completed into the diversity of impact that robotic exercise device can impact clinical rehabilitation.

> **"I now feel I have a freedom from pain and fatigue to live my life to my full potential"**
> - SCI Participant

CONCLUSION:

Standing while completing upper body rehabilitation and strengthening in a stand-alone robotic exercise device can significantly enhance neck and shoulder pain management and improve quality of life. Highlighting that robotic exercise devices can offer a range of rehabilitation opportunities as well as gait training.

Want to see some of the clinical program watch this short video https://youtu.be/rbsZTHh_gaQ

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References
Barbareschi, G., Richards, R., Thornton, M., Carlson, T., Holloway, C. 2015. Statically vs dynamically balanced gait: Analysis of a robotic exoskeleton compared with a human. *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS.* 2015-November, 7319937, pp. 6728-6731

Barbetta, DC, Lopes ACG, Chagas FNMR, Soares PT, Casaro FM, Poletto FM, de Carvalho Paiva Ribeiro YH and Ogashawara OT. 2016. Predictors of musculoskeletal pain in the upper extremities of individuals with spinal cord injury. *Spinal Cord* (2016) 54, 145–149; doi:10.1038/sc.2015.126

Birch et al. 2016 RAPPER II: Introduction. *Presentation at ACRM* November 2016.

Dalyan M, Cardenas DD and Gerard B.1999. Upper extremity pain after spinal cord injury. *Spinal Cord* March, Volume 37, Number 3, Pages 191-195

Eng, J.J., Levins, S.M., Townson, A.F., Mah-Jones, D., Bremner, J., Huston, G. 2001. Use of prolonged standing for individuals with spinal cord injuries. *Physical Therapy* Volume 81, Issue 8, 2001, Pages 1392-1399